

REMARKS

Claims 21-40 are pending in the application. Applicants thank the Examiner for allowance of claims 21-28, 34-36 and 40. Claims 29-33 and 37-39 are rejected.

Response to Claim Rejections Under 35 U.S.C. § 102

Claims 29-33 are rejected under 35 U.S.C. § 102(e) as being anticipated by Yamamoto (U.S. Patent Application Publication No. 2002/0153579).

Applicants respectfully traverse the above § 102(e) rejection, at least for the following reasons.

Present claim 29 recites a semiconductor device comprising a gate insulating film and a gate electrode stacked in this order, and in contact with each other. As recited in claim 29, the gate insulating film comprises a nitrogen containing high-dielectric-constant insulating film in which nitrogen is introduced into metal silicate and a nitrogen atom selectively bonds with a silicon atom in metal silicate.

Turing to Yamanote, the semiconductor device of Yamanote comprises an electrode made of a metal or a metal nitride and which is formed on a silicon layer via a dielectric film. Alternatively, the semiconductor device of Yamanote comprises an electrode which is made of silicon or a silicon germanium and the electrode is formed on a silicon layer via a dielectric film. The dielectric film of Yamanote has a multi-layer structure comprising a first amorphous oxide film on the side of the silicon layer, a second amorphous oxide film on the side of the electrode, and a metal oxide film between the first and second amorphous oxide films.

Furthermore, paragraph [0076] of Yamanote teaches:

“a film of a metal or metal nitride such as titanium nitride (TiN), aluminum (Al), ruthenium (Ru) and the like is formed by sputtering on the ZrO₂ film 4”

Therefore, in the metal nitride film of Yamanote, nitrogen is not introduced into metal silicate and nitrogen atoms do not selectively bond with silicon atoms of the metal silicate, as presently claimed.

Accordingly, Yamanote does not teach and every element of claim 29, thereby rendering claim 29 patentable over Yamanote. Claims 30-33 are also patentable, at least by virtue of their dependence from claim 29.

Therefore, Applicants respectfully request reconsideration and withdrawal of the § 102(e) rejection of claims 29-33 based on Yamanote.

B. Claims 37-39 are rejected under 35 U.S.C. § 102(b) as being anticipated by Lee et al (U.S. Patent No. 6,844,604). Initially, Applicants submit that Lee is a reference under 35 U.S.C. § 102(e) and not a reference under 35 U.S.C. § 102(b).

Applicants respectfully traverse the § 102(e) rejection of claims 37-39 based on Lee, at least for the following reasons.

Present claim 37 recites a semiconductor device comprising a gate insulating film and a gate electrode stacked in this order, and in contact with each other. The gate insulating film has a layered structure having, from the silicon substrate side, a first silicon oxide film, a metal oxide film or a metal silicate film and a second silicon oxide film, and only the second silicon oxide film has a structure in which nitrogen is introduced into silicon oxide.

The gate insulating film **15** of Lee encompasses the silicate interface layer **12** and the high-k dielectric layer **14**. Silicate interface layer **12** is made of a metal silicate $M_{1-x}Si_xO_2$, where the metal “M” can be Hf, Zr, Ta, Ti or Al. The high-k dielectric layer **14** is a multilayered structure where HfO_2 or ZrO_2 layers alternate with Al_2O_3 layers, with the topmost layer preferably being Al_2O_3 . At column 8, lines 30-35, Lee teaches that

“the present invention provides a dielectric layer structure having the advantages of silicon dioxide but without the disadvantages of the prior art.”

Therefore, Lee teaches away from using SiO_2 as a dielectric layer.

Additionally, although at column 2, lines 13-17, Lee discloses the use of a oxynitride layer interposed between a silicon substrate and a high-k dielectric layer, it does not disclose that it is only the second silicon oxide film that has nitrogen, as is presently claimed.

Therefore, Lee does not teach each and every element of claim 37, and claim 37 is patentable over Lee. Claims 38-39 are also patentable, at least by virtue of their dependence from claim 37.

In view of the above, Applicants respectfully request reconsideration and withdrawal of the § 102 rejection of claims 29-33 and 37-39 based on Lee.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

RESPONSE UNDER 37 C.F.R. § 1.111
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